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ABSTRACT

Because research indicates that specific cognitive deficiencies do exist for hearing-impaired individuals (though the normal range of intellectual potential exists among the hearing-impaired as a group), Instrumental Enrichment (IE), an approach developed originally in response to the need for mediated learning experiences for culturally disadvantaged groups, was applied to the education of hearing-impaired secondary students. IE allows students to reflect on their own thinking processes, develops the prerequisites for learning, recognizes the age-specificity of developing generalizable cognitive strategies, and promotes skill transfer. Over a 2-year period, 18 control group students and 10 experimental students are being studied. Preliminary evaluation (after 1 year) data included performance on Raven's Standard Progressive Matrices, the Stanford Achievement Test, Hearing Impaired Version: Reading Comprehension subtests, problem solving interviews, and a teacher observation checklist. Among findings were that Ss approached problem solving curricular situations more systematically and with less impulsivity; Ss improved in their ability to analyze the component parts of a problem and in their understanding of the reasons underlying required assignments in English and mathematics. Preliminary results suggest that the intervention may be effective for improving spatial reasoning skills, ability to consider two or more sources of information simultaneously, and understanding of cause and effect. Sample modifications for IE are suggested. (CL)

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COGNITIVE EDUCATION FOR THE HEARING-IMPAIRED ADOLESCENT

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THE PROBLEM

Teachers who work with hearing-impaired adolescents frequently express deep concern and frustration about some of their students' serious deficiencies in problem-solving skills, as evidenced in both classroom and written work. The concern often relates to difficulty with manipulating more than one variable, conceptualizing what a textbook or journal author is saying, forming conclusions, dealing with hypothetical data, and spatial reasoning. Yet research with hearing-impaired adolescents has documented that no basic malfunctions are present in the cognitive abilities of that population and that any inferiorities in cognitive performance may be accounted for by experiential and linguistic deficits and communication handicaps (Levine, 1976, 28).

THEORETICAL BACKGROUND

Studies in cognition in relation to hearing-impaired individuals have been numerous in recent years. After an initial period of focusing on I.Q., the center of attention now is on the processes involved in cognition and perception. It appears to be widely accepted that hearing-impaired individuals have the normal range of intelligence when tested on the performance, rather than the verbal, subtests of various I.Q. instruments (Drever & Collins, 1928), with the exception of students who have neurological impairments resulting from an etiology of hearing loss that has multiple effects (Vernon, 1968, 8).

It is useful to review what prior researchers have reported in regard to specific cognitive skill performance in hearing-impaired individuals:

a. Memory: More than eighty years of research indicates that the profoundly deaf perform less well than the normal hearing on short-term memory tasks, as well as on certain other cognitive tasks (Karchmer & Belmont, 1976, 1).

b. Concept Application: Meadow reports that hearing-impaired subjects learn concepts in the same sequence as the hearing, but at a later time (Meadow, 1980, 72).

c. Parts-Wholes: Furth found no difference in performance of deaf compared to hearing children (Furth, 1964, 146).

d. Opposition: Furth found inferior performance among deaf children (Furth, 1964, 146); the same finding was reported later by Meadow (Meadow, 1980, 72).

e. Sameness: Furth found deaf children to be "equal" to hearing children on understanding of sameness (Furth, 1964, 146); Meadow reported "little retardation" for hearing-impaired children in this domain (Meadow, 1980, 72).

f. Analogy: Meadow reported difficulty for hearing-impaired children in this area (Meadow, 1980, 72).

g. Superordinate Reasoning: Both the vocabulary and concept of cause-effect relationships are reported to be more difficult for hearing-impaired youth (Johnson, 1981).

h. Symmetry: Both Furth (1964, 146) and Meadow (1980, 72) found little, if any, difficulty for hearing-impaired children in this skill.

i. Classification: Prior research has reported that hearing-impaired children perform less well than hearing children on classification tasks which depend on verbal interaction with the environment (Best & Roberts, 1975). However, more recently, little retardation for hearing-impaired children is reported (Meadow, 1980, 72) in this skill area.

j. Spatial Reasoning: One study found that deaf students are more field-dependent compared to hearing students and that spatial skills are significantly related to performance on a field-dependence test (Parasnis & Long, 1979, 34-35), suggesting that the effect of auditory deprivation and/or knowledge of sign language for congenitally deaf individuals may be weak cerebral lateralization and thus greater field-dependence.

k. Working with more than one type of data: Recent research indicates that hearing-impaired individuals showed difficulty on tasks requiring reference to two items of data, as compared to hearing individuals (Ottem, 1980, 568).

Thus, we see normal performance by hearing-impaired individuals on some cognitive tasks and not on others; we also see controversy among the researchers, as well as a number of unanswered questions for further research.

RATIONALE FOR INTERVENTION

If we accept the fact that certain specific cognitive deficiencies do exist for hearing-impaired individuals but that no evidence suggests less than the normal range of intellectual potential among hearing-impaired individuals as a group, then it is apparent that a specific program of activity in an educational setting may promise improvement of these skills. In addition, a program which was originally developed to improve the performance of disadvantage-hearing children who had some of the same deprivation of thinking skill opportunities as the hearing-impaired children may well be specifically the type of program which is adaptable for this special purpose.

Such a program is Instrumental Enrichment (IE), developed originally in Israel by Reuven Feuerstein (1978, 1980), a student of Piaget, in response to the need for mediated learning experiences for culturally disadvantaged groups emigrating to Israel. This program provides an excellent mechanism in relation to the results of those studies cited earlier for the following reasons:

a. It uses a "metacognition" approach in that students are given repeated opportunities to reflect on their own thinking processes.

b. Unlike cognitive training programs focusing on impulsivity as a personality characteristic, Feuerstein's work assumes that impulsivity is a characteristic of the "retarded performer" due to his lack of adequate mediated learning experience; thus, IE assumes that impulsivity may be reduced or eliminated, but for a different reason than the other programs.

c. IE definitely develops the prerequisites for learning and does not assume that those prerequisites already exist in the learner (an assumption made in several of the less-than-completely-successful intervention programs mentioned elsewhere in the literature).

d. IE recognizes the age-specificity of developing generalizable cognitive strategies: Feuerstein is unambiguous about the IE program's appropriateness only for learners at the representational level of thinking and beyond.

e. IE does not assume that generalization will automatically occur; rather, a critical element in the daily instructional sequence for IE is the "bridging" exercise in which the teacher overtly and actively promotes transfer by the student of skills to both real-life and curricular situations. This activity occurs during group discussion for insight and requires specific teacher training.

Thus, because of its avoidance of the pitfalls of earlier programs in the above respects, the IE program represents a highly logical intervention step in the history of cognitive intervention programs.

IE is particularly promising in regard to the above-mentioned research results on hearing-impaired learners' cognitive development, in that Feuerstein states as specific IE objectives the improvement of the following skills:

a. Spatial reasoning

b. Ability to manipulate several sources of information simultaneously

c. Understanding of cause and effect relationships.

IE's objectives, of course, go beyond the above (e.g., restraint of impulsivity, problem identification, development of logico-deductive reasoning, and reduction of egocentricity, among numerous others); however, these three objectives relate directly to deficits in the hearing-impaired as mentioned in the literature.

RESEARCH PROJECT

A special two-year pilot project is now under way at the Model Secondary School for the Deaf (MSSD) at Gallaudet College in Washington, D.C. A control group of eighteen students and an experimental group of ten students are being

studied using various measures of cognitive functioning to assess the success of the Instrumental Enrichment intervention. Groups were matched on the basis of age, sex, degree of hearing loss, and reading ability. Hearing loss averaged 88 dB; reading level averaged 4.5 (GES) on the SAT-HI; and age averaged 16.5 years old. After one year of intervention, the results reported below were found from preliminary data collection.

INSTRUMENTS

Three questions needed to be answered in the evaluation. First, could the students learn the training task itself? Second, could the students generalize the training to a specific curricular situation? Third, could the training generalize to other situations? To answer each of these questions, three separate data collections were planned.

1. Raven's Standard Progressive Matrices assess general intellectual capacity by requiring an individual to solve a series of increasingly difficult abstract design problems. The test is a multiple-choice, untimed format which can be given individually or in small groups. The Raven's was selected as particularly appropriate for assessing students' analogical reasoning, systematic planning behavior (restraint of impulsivity), and distinction between relevant and irrelevant cues. The Raven's was administered to both experimental and control subjects in December and in May.

2. Stanford Achievement Test Hearing Impaired Version: Reading Comprehension subtest uses multiple choice responses to written questions to assess an individual's ability to construct a coherent interpretation of an extended prose passage as well as measuring specific decoding skills such as finding main ideas or locating supporting data. It is a timed test which is

intended to be given in a group setting. The SAT-HI was selected as a measure of inferential thinking, understanding of implicit meaning, and ability to consider multiple sources of information. All MSSD students were given the entire SAT-HI battery during November, 1981; the experimental and control students took it again in November, 1982.

3. Problem-Solving Interviews were substituted for written responses to problem-solving situations because it was felt that the extra burden of writing English answers might mask some of the possible effects of the training. Each experimental and control subject was interviewed in December and in May/June, using the following format. The students were asked three questions by a deaf research assistant who qualified as a native user of ASL. The three questions were:

1. Suppose you are responsible for planning a trip for a class to go from MSSD to downtown Washington for a whole day to visit the Capitol building. What steps would you take? Please list the things you would have to plan.

2. If you had to tell someone exactly how to walk from the Auditorium at MSSD to the Cafeteria, what directions would you give him or her?

3. You are in a restaurant downtown with an MSSD friend. After dinner, your friend becomes sick from the food he has eaten. He can't walk, and he is in pain. The restaurant manager refuses to help you. What would you do?

The students were videotaped responding to the questions. Problem-solving interviews were selected as a means of assessing students' planning behavior, problem-identification ability, skill in dividing a problem into its components, and understanding of cause and effect relationships.

FINDINGS AND DISCUSSION

1. Raven's Matrices. Since there are no suitable norms for hearing-impaired children for this test, simple frequency of correct responses was

used as the best estimate of change in ability as the result of training and are shown in Table 1 below.

Table 1

Comparison of Pre- and Post-Test Results on Raven's Matrices

	Experimental	Control
Pre-training	40.00 (6.98)	43.40 (6.26)
Post-training	43.50 (7.93)	44.50 (5.87)

(Kluwin, 1982)

Table 2 below represents the results of a one-way analysis of variance on the difference between the pre-training test and the post-training test. The results represent differences in the numbers of correctly completed items.

Table 2

Difference Scores on Raven's Matrices

	Mean	S.D.
Experimental	3.50	6.95
Control	1.10	4.65

Mean Square = 28.800

F value = 0.824

df = 1.18; p value = .376

(Kluwin, 1982)

Table 3 below represents an attempt at a non-parametric measure of score change.

Table 3

Changes in Individual Scores on Raven's Matrices

	Gain	Loss	Same
Experimental	7	3	0
Control	4	5	9

(Kluwin, 1982)

While there were no statistically significant differences between the two groups on the basis of the number of items correctly completed on the Raven's Matrices, there is, however, a trend in the data. The experimental group did perform better than the control group. The reason that no clear difference is describable is that there is a considerable amount of variance within both groups. This unaccounted-for variance within such a small sample reduces the probability of locating a statistically significant difference.

Another way to consider the change in the scores is to look only at the differences in the directions scores. Tables 2 and 3 taken together suggest that some of the experimental students had significant score changes, but others did not. Such a result would suggest that the training may be effective for certain types of students (Kluwin, 1982, 6).

2. Stanford Achievement Test, Reading Comprehension Results. The results of the November, 1981 versus the November, 1982 administrations of the Stanford Achievement Test for Hearing-Impaired, Subtest on Reading Comprehension, for both groups are summarized and compared in Table 4.

Table 4

Difference Scores on Stanford Achievement Test, Hearing-Impaired Subtest on Reading Comprehension

	November 1981	November 1982
	Mean	Mean
Experimental	148.5	154.1
Control	146.8	150.6

Mean Square = 57.624

F value = .308

df = 1.24; p value = .584

Comparison of scores reveals that no statistically significant difference in reading comprehension was found as the main effect of IE treatment, using the 1981 pre-test SAT-HI score as a covariate. The Reading Comprehension areas dealing with analysis of explicit and implicit meaning, meaning from context, and inference therefore does not appear statistically to differentiate these two groups. A trend favoring the experimental group, however, is again evident. Once again, the small sample size is at least one important factor in this analysis.

However, subsequent analysis of the difference between means within each of the two groups between pre and post test revealed one promising result. A t-test for significance of difference between two means for correlated samples showed no significant difference within the control group between pre and post testing, while the same test for the experimental group revealed a gain in mean score which was significant at the .05 level. The latter result would

confirm the importance of carrying out additional research with larger sample sizes in the future, so as to examine further the effects of IE on such subjects.

3. Problem-Solving Interviews: Procedures and Results. Each subject was interviewed by a deaf individual before and after the training. From these videotaped interviews, three sets of videotapes were prepared for analysis. Each videotape contained one set of responses--that is, pre and post--for each individual in the experimental and control groups. Table 5 below represents the number of individuals for each of the two groups who had a higher rating for their post-test.

Table 5

Number of Individuals with Higher Post-Test Ratings on Interviews

Question #	Practicality	Completeness	Organization	Systematic Planning
1 Experimental (n=9)	2	2	3	2
Control (n=9)	0	1	1	0
2 Experimental (n=9)	1	4	1	1
Control (n=9)	0	0	0	0
3 Experimental (n=9)	4	0	1	1
Control (n=9)	0	0	0	0
Total Questions				
Experimental (n=9)	7	6	5	4
Control (n=9)	0	1	1	0

(Kluwin, 1982)

There is a trend apparent here, but it should be interpreted generally. We can consider that some of the experimental students were able to generalize from the training to another situation. Such a result suggests that the procedure works for some children, but may not work for all.

4. Teacher Observation of Behavior. Teachers of all experimental students were asked to rate students' cognitive behavior before the beginning of the experimental period and again near the end of the first project year, using a five-point scale of behaviors which reflected the major goals of IE (See Table 6). The reporting teachers were not those involved in the teacher-training group; thus, they had no specific preconceived expectations for any changes in student behavior.

Weights were assigned to each of the points on the scale with 5 being the highest possible value; responses were tallied across respondents and means were then determined for each scale item. The weighted means were then compared between pre- and post-surveys to determine changes in teacher-perceived behavior of experimental students. No tests of statistical significance of differences were possible because of the small sample size. However, differences were inspected for clear trends. Changes between pre- and post-survey items of .3 or more were considered to be noteworthy as trends.

The following items exhibited a change of .3 or more:

2, 9, 11, 16, 18, 19, 24, 25.

A discussion of these admittedly subjective observations must relate the reported behavioral trends in relation not only to the goals of IE but also to the typical classroom activities which characterize the teaching in IE classes.

Item #2. The clear increase (.3) in the use of the dictionary is explained in two ways: (a) the dictionary itself is frequently used to check on vocabulary terms during IE sessions, and (b) the awareness level of words

Table 6

Teacher Observation Checklist:
Weighted Means for Experimental Group

TYPICALLY, THIS STUDENT	Pre (1=low; 5=high)	Post (1=low; 5=high)
1. Corrects own mistakes spontaneously	2.7	2.6
*2. Uses dictionary spontaneously	1.8	2.0*
3. Takes responsibility for own supplies	3.5	3.4
4. Settles down to work rapidly at beginning of class	3.3	3.3
5. Makes a minimum number of errors and erasures	2.0	2.9
6. Reads and follows directions spontaneously	2.8	2.6
7. Takes responsibility for making up work missed	2.7	2.6
8. Concentrates on task at hand for appropriate period of time	3.6	3.6
*9. Expects himself/herself to be precise, exact	2.9	3.2*
10. Gives relevant and complete answers to questions	3.4	3.3
WORK HABITS		
*11. Willing to help others in class	3.1	3.8*
12. Approaches new tasks and work with confidence	2.9	2.7
13. Participates willingly in oral discussions	3.2	3.1
14. Volunteers to do extra work	2.1	2.0
15. Looks for alternative ways of doing things	2.5	2.5
*16. Works well with others in a group	3.1	3.4*
17. Is enthusiastic about learning	3.2	3.1
*18. Is considerate of others' feelings and listens to others	3.3	3.8*
*19. Act without impulsivity	3.0	3.5*
20. Avoids being involved in fights and arguments	3.0	3.2
CLASSROOM BEHAVIOR		
21. Use problem-solving vocabulary taught	2.9	3.0
22. Develops new Instrumental Enrichment exercises	2.0	1.9
23. Other teachers report he/she uses IE strategies in other classes	-	-
*24. Can describe use of several problem-solving strategies to others	2.1	2.8*
*25. Will defend own opinions on basis of logical evidence	3.0	3.3*

*Increase of +.3 or more

per se is clearly higher for IE classes as evidenced by the impressive cumulative list of new terms that students learn and apply throughout the year. In the experimental classes, a total of 85 new words were introduced and used regularly, as shown by observations of classrooms by the investigator.

Item #9. The reported increase (.3) in student self-expectation of greater precision is directly traceable to the regular emphasis on precision of responses--both on paper and during discussions in IE work. Students are continually reminded, first by the teacher, later by their peers, and ultimately by themselves to check their work for exactness.

Item #11. The significantly increased willingness to help others in class (.7) is interesting because such willingness is not an overt goal of IE. However, it is understandably a behavioral by-product because peer mediation and assistance is actively and regularly encouraged by the structure of IE lessons, in which students are given ample opportunities to work with each other during and after completion of their particular assigned paper-and-pencil exercises. In addition, students regularly perceive in IE that the teacher will not always provide them with the correct answer without students having to work out solutions themselves, thus reinforcing this type of behavior.

Item #16. The increase in working well with others in a group (.3) is explained similarly to the increase reported in peer assistance above (Item 11). In addition, the consistent teaching style of group discussion following completion of each day's exercises also clearly reinforces positive intra-group behavior by members of the class. The relatively small size of classes at Model Secondary School (an average of eight students), together with

a program such as IE which facilitates and requires group discussion, produces a social situation in which group cooperation is important because any violation of that cooperation is highly obvious to others within the group. That this behavior is self-reinforcing and transferred to the context of other non-IE class sessions is therefore not surprising, though it is positively encouraging to report.

Item #18. The reported increase (.5) in consideration of others' feelings and increase in "listening" behavior is somewhat related to the explanation reported above (Item #16). However, the improvement in "listening" skills (the hearing-impaired equivalent is "visually attending closely" to others' signed responses) is worthy of special mention. IE teachers took class time to focus on methods of positively critiquing a peer student's work. The fact that the experimental students were reported to have made improvement in attending to each other is indicative of the success of a program which encourages openness to alternative solutions to problem situations. Such openness is critical to success in a complex world of both cognitive and affective challenges.

Item #19. The reported decrease in impulsivity (.5) is directly related to one of the major goals of IE: to encourage students to take time to think through a problem before embarking upon a solution. The teaching style is a continual reminder to "Stop and Think" in various ways, and again, students begin to remind each other about the importance of not jumping on the first solution which comes to mind. It is especially encouraging, however, that this habit is transferred beyond the immediate IE-lesson context to other classrooms with other teachers.

Item #24, the large reported increase in the use of multiple problem-solving strategies (.7) is once again directly related to the goals of IE in

the reduction of simplistic approaches to problem-solving and the reinforcement of keeping more than one variable in mind at the same time. This achievement is also related to the production of improved divergent thinking, although Feuerstein does not use that particular term in the theoretical background for IE. Such a skill is indeed important in many cognitive areas of the curriculum.

Item #25. The increase (.3) in the defense of one's own opinions on the basis of "logical evidence" is the direct result of IE class discussions in which students must present their solutions and defend them to their peers before the teacher reinforces any one solution. Although logical-deductive thinking is not an in-depth focus of IE until an instrument by that name is introduced in the third year of the program, students are nonetheless required to go about solving problem situations in all of the program's instruments in a quasi-logical sequence. Thus, it is predictable that such improvement would result.

While teacher-reported observations by teachers not trained in IE are admittedly subjective and perhaps questionable because no simultaneous evaluation was done on control students, these data in any case provide evidence for some of the early effects of this program on hearing-impaired adolescents. As such, this type of data supplements the results provided elsewhere in this report.

SUMMARY OF RESULTS

At the end of the first pilot year, some important and consistent effects can already be reported:

a. Hearing-impaired students now approach problem-solving situations in the curriculum more systematically and with less impulsivity.

b. Students have improved in their ability to analyze the component parts of a problem.

c. Students have improved in their understanding of the reasons behind required assignments in English and Mathematics.

d. Significant growth in vocabulary usage has been observed in sign language; no evidence of growth in written application of these words has been observed as yet.

e. Higher student motivation in problem-solving tasks has been noted by teachers.

f. Students are now working with peers in problem-solving tasks with less reported "black-and-white" thinking or simplistic criticism of peers' work as either right or wrong; rather they appear to be better able to analyze individual components of peers' work as to which elements are right and wrong and why.

g. Important increases in peer cooperation and positive approaches to criticism by students have been clearly noted.

h. Student interview results indicate a statistically significant improvement for the experimental group in practicality, completeness, organization, and systematic planning in their approach to problem-solving situations (Kluwin, 1982, 8).

i. Although no statistically significant change was found on the measure of abstract thinking, a clear trend in favor of the experimental group was found (Kluwin, 1982, 6).

j. Teacher observation checklists indicated that the experimental students more frequently expected themselves to be precise, were able to describe several strategies to solve a problem, and defended their opinions on the basis of logical evidence.

k. Experimental students showed significant gains in reading comprehension.

In regard to the cognitive problems of the hearing-impaired cited earlier in the review of the literature, this preliminary data appears to indicate that the intervention holds promise for the improvement of: spatial reasoning skills (Parasnis & Long, 1979), ability to consider two or more sources of information simultaneously (Ottem, 1980), carry out analogical reasoning

(Meadow, 1980), and understanding of cause and effect relationships (Johnson, 1981). In addition, the emphasis on metacognition activities during IE lessons must be considered as at least one factor in the improvement of experimental students; this interpretation should corroborate the finding elsewhere (Peterson, et al., 1983) that students who can explain why they understood a cognitive task tend to have higher achievement scores.

PROGRAM ADAPTATIONS FOR HEARING-IMPAIRED ADOLESCENTS

In working with this special cognitive intervention program, several adaptations have been important in relating the program to hearing-impaired adolescents. Among them, the following have been reported by the pilot teachers:

a. The natural use of American Sign Language (ASL) by students in the classroom makes it imperative that teachers ask students to restate their responses in Manual English, in order to check on their understanding of the particular concept or category which is being discussed during an Instrumental Enrichment class.

b. Some additional classroom time is needed for the translation of English terminology to ASL.

c. Students require continual reinforcement and illustration of the ways in which "bridges" can be made between intervention exercises and subject-matter applications.

Other than the above, however, the close relationship between IE and verbal mediation appears to have made further modifications of the program unnecessary for a hearing-impaired population.

CONCLUSIONS

From the results reported above, the following conclusions may be drawn:

a. There was an improvement in the students' ability to do the kind of problem-solving that the first year of training focused on, but the implications of that improvement are somewhat overshadowed by the considerable variance within the group and the possibility of a "ceiling effect" for the control group.

b. The training apparently helped some of the students with their ability to solve problems. There is a trend for generalization of the training for some of the students.

c. The teacher observation data clearly establish the importance of systematic cognitive intervention in the context of the ongoing school curriculum.

d. Larger student samples and more complex evaluation designs are needed in order to assess in more depth the statistical effects of this intervention for hearing-impaired adolescents. Included in such studies should also be an investigation of possible aptitude-treatment interactions.

e. Teacher training in cognitive education is an essential prerequisite to the success of any cognitive intervention program with students.

f. The strong teacher testimonials to the positive effects of IE suggest that future studies investigate in depth the perceptions of teachers and the reasons behind those perceptions.

The continuing high enthusiasm of the pilot teachers has led to the involvement of ten additional teachers at the school in the training for 1982-83. Thus, we see strong professional commitment to the idea that positive growth is occurring in the problem-solving skills of the students in this population. Such professional commitment and enthusiasm may be the most important indicators of all.

EDUCATIONAL IMPORTANCE

Systematic cognitive intervention for adolescent hearing-impaired learners is now demonstrated to be effective within non-clinical settings, provided that appropriate materials and adequate teacher training are made available prior to and during the intervention. More specifically, this study has the potential of great impact in cognitive education for special groups because it has now been demonstrated or confirmed that:

a. Language is a critical medium for the development of prerequisite cognitive skills for problem solving.

b. Hearing-impaired students can indeed improve their cognitive skills to a measurable degree.

c. Adolescence, while late in the development cycle, is clearly not too late for effective, systematic intervention in cognitive strategies.

d. The skills of projection of virtual relationships, comparison, analytic perception, and orientation in space are important prerequisites for adequate problem-solving behavior.

The present study thus provides important base-line data for cognitive intervention in the hearing-impaired adolescent and will be useful for future research with larger populations in this educational domain.

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